The Cowrie Species Living at Guam

BY

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(Plates 16 to 25; 1 Map)

INTRODUCTION

Ingram (1938) published a list of 18 cowrie species from the Micronesian Island of Guam. His findings were based upon collections made there in the years of 1923, 1925, and 1937. Almost all of the specimens are said to have been collected in Tumon Bay. Schilder (1938/39) identifies 33 species from Guam. In recent years (1956 and 1959) two separately executed mimeographed cowrie lists have appeared on the island itself. Otherwise, at various intervals only minor reference has been made to the existence of cypraeids there.

It is the purpose of this report to bring up to date the information we now possess about the cowrie family at Guam. Listed will be all presently known cowrie species living in the coastal waters of Guam; accurate collecting station data on the individual species will be given; a revised taxonomic system and nomenclature (*fide* Schilder, 1966, 1968) will be used, and the species will be illustrated for comparison and identification.

During a visit to Guam in November, 1966 I was able to visit shell-collecting friends and examine their collections. I was able to obtain from these collections a fairly clear picture of population densities for each species; my estimates were later confirmed in conversations with the collectors. With the exception of a number of species that are very common at this island and at most Pacific localities, there are about a dozen species that should be called fairly common, with the remainder of the species to be regarded as uncommon to rare.

Guam is located in Oceania (Micronesia) approximately 1500 miles east of Manila and some 3000 miles west of the Hawaiian Islands, roughly at 14°00′ N Latitude and 114°30′ E Longitude. It is the southernmost and largest of the 15 recognized islands of the Marianas Group, the northernmost group of islands and atolls in Micronesia.

The island of Guam consists mostly of undulating hills and sharp outcroppings of rock; a wide variety of cypraeids is found in Guam waters, and the long coastline provides a variety of ecological conditions for these animals, a point that I will enlarge upon below.

ECOLOGY and HABITAT

The beach and its intertidal zone and the reefs provide good shell collecting. At many points around the island, notably at Two Lovers' Point, the cliffs are steep, dropping off precipitously to the shoreline below or directly into the sea itself. These areas provide a habitat for the species that require the more turbulent, aerated water for their survival. Otherwise, as with most islands in the tropics, the coasts and the bay areas are lined with reefs and coral shallows.

The reefs vary in the amount of exposed surface at low tide, some barely clearing the very tops, others draining free and exposing much marine life. The lengths and widths of the reefs vary; they consist of both dead and living coral, with emerging lava-basalt in evidence nearly everywhere. This habitat is often sharp and jagged, and covered with many species of algae; some substrates are age-worn, trapping patches of sand into large and small drifts; some reef areas in protected environments have loose, movable rocks, boulders, and coral slabs, all of which are the habitats of cowries.

The beach localities vary from broad, uncluttered sand expanses to sand with rocky outcroppings to surf-pounded rough rock and coral rubble shelves. In the many bays are tremendous low-tide expanses of very shallowly covered (2 to 12 inches of water) porous sand on which many of the more common cowrie species are crawling. *Erosaria caputserpentis* (Linnaeus, 1758) and *Monetaria moneta* (Linnaeus, 1758) seemed to be underfoot everywhere in Agaña Bay.

During my visit I was able to make a circuit of the island and see the various habitats, collecting at some of them. I was surprised at the warmth of the water.

Even though the list of presently known species is quite extensive, there yet may be more deep water species to be discovered in the future. For example, recently *Bistolida*

goodalli fuscomaculata (PEASE, 1865) and *Palmadusta lutea lutea* (GMELIN, 1791) were found at Guam for the first time; the latter species was collected, by good fortune, during my visit to the island, affording me an opportunity to examine it with the living animal still in the shell.

In instances where quantities of available material permit, I list the measurements (in millimeters) of the largest and smallest specimen to indicate the size range and variability of the Guam species. The formula of 5 numerical combinations, given at the beginning of each species listing, indicates length, width and height of the shell with the other two numbers giving the number of teeth on the outer lip and the number of teeth on the inner margin of the columella-base. Under the heading "Localities" a numerical reference is given to the accompanying "Locality Index."

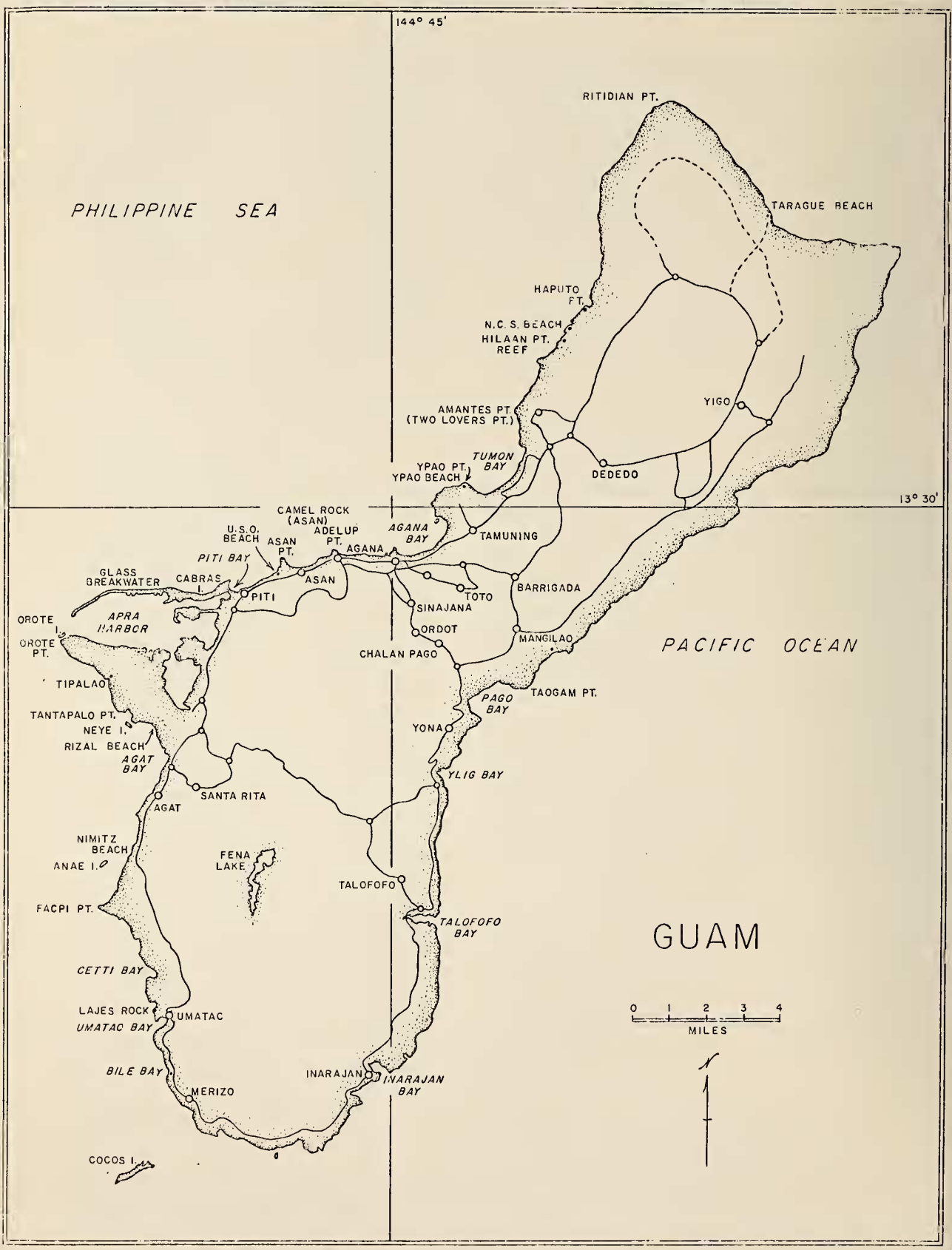
ACKNOWLEDGMENTS

It has been only in recent years that intensive attention has been given to shell collecting in the Guam area. Military and governmental employees constitute most of the workers in this field. It follows that these people are the source for most of the information contained in this paper. I list in alphabetical order the workers most responsible for specimens and collecting information made available to me for this report: Mrs. Phyllis Eliason, Donald and Kay Hiatt, Rica and Floyd Miller, Louise and Tom Montgomery, Lorraine and Kenneth Rhein, and Herbert Ward, all of Agaña. I wish to express to them all equally my deep appreciation for their eager and generous help. My thanks go to Mrs. Emily Reid, Berkeley, California, for the fine map; and to Jean Cate for constant help, encouragement, and suggestions; to Dr. Takeo Susuki for assistance in processing film; and to Dr. L. G. Eldredge, Department of Zoology, College of Guam, for references to the literature.

LOCALITY INDEX

1. Anae Island
2. Asan
3. Asan Point
4. Adelup Point
5. Agaña Bay
6. Agat Bay
7. Apra Harbor
10. Bile Bay
13. Cabras Island
14. Camel Rock (Asan)
15. Cetti Bay
16. Cocos Island
17. Facpi Point
20. Glass Breakwater
23. Hilaan Point Reef
24. Haputo Point
27. Inarajan Bay
28. Lajes Rock
30. Mangilao
31. Merizo
35. NCS Beach
36. Neye Island
37. Nimitz Beach
40. Orote Point
43. Pago Bay
44. Piti Bay
45. Piti Bay Reef
47. Ritidian
48. Rizal Beach
50. Tantapalo Point (Orote Peninsula)
51. Taogam Point
52. Tarague Beach
53. Tipalao
54. Talofofo Bay
55. Tumon Bay
59. Umatac Bay
60. U S O Beach
64. Ylig Point (Ylig Bay)
65. Ypao Point (Ypao Beach)

SPECIES INDEX


144° 45'
13° 30'
PHILIPPINE SEA
PACIFIC OCEAN
GUAM
RITIDIAN PT.
TARAGUE BEACH
HAPUTO PT.
N.C.S. BEACH
HILAAN PT. REEF
AMANTES PT. (TWO LOVERS PT.)
YIGO
DEDEDO
TUMON BAY
YPAO PT.
YPAO BEACH
CAMEL ROCK (ASAN)
U.S.O. BEACH
ASAN PT.
ADELUP PT.
AGANA
AGANA BAY
TAMUNING
PITI BAY
GLASS BREAKWATER
CABRAS I.
PITI
ASAN
TOTO
BARRIGADA
SINAJANA
OROTE I.
APRA HARBOR
OROTE PT.
ORDOT
MANGILAO
CHALAN PAGO
TIPALAO
TAOGAM PT.
PAGO BAY
TANTAPALO PT.
NEYE I.
YONA
RIZAL BEACH
AGAT BAY
YLIG BAY
SANTA RITA
AGAT
NIMITZ BEACH
ANAE I.
FENA LAKE
TALOFOFO
FACPI PT.
TALOFOFO BAY
CETTI BAY
LAJES ROCK
UMATAC
UMATAC BAY
BILE BAY
INARAJAN
INARAJAN BAY
MERIZO
COCOS I.
0 1 2 3 4
MILES

1. *Mauritia (Leporicypraea) mappa* (Linnaeus, 1758)

(Plate 16, Figures 1, 3a, 3b)

Localities: 3 7 16 23 31 44 45

Normal shell measurements:

Largest shell:	75.5	52.0	42.1	39	31
Smallest shell:	75.9	48.8	40.6	38	31

Apra Harbor dwarf variant:

Largest shell:	53.1	31.6	26.8	37	37
Medium shell:	50.5	29.3	24.2	37	36
Smallest shell:	43.6	25.0	21.1	37	34

The species is uncommon, found only in a few restricted localities. The Guam shells seem to have a color affinity with the Philippine representatives of the species, possessing more of the pinkish coloring and less of the plain white to very pale beige base as seen in specimens from the Ryukyu Islands and more southern Pacific localities. The most outstanding feature is the size difference between the specimens collected in Apra Harbor and those from elsewhere on the island. There is a dwarf population, occurring together with the larger, normal appearing forms, in Apra Harbor, although the two forms apparently do not occupy exactly the same habitat. Aside from the small size there seems to be no other aberration; the shell is normal in appearance except that it is narrower, the teeth much smaller, finer, and more numerous on the columella, giving the effect of elongation of the characters normally attributed to the species. These shells are not just of freak occurrence, for I have examined no less than 8 specimens; the 3 listed here are in my own collection (Cate no. C3448). The species, though most commonly encountered in Apra Harbor, is found on the underside of coral and lava rocks, in small marine caves, and in coral pockets in the reef areas at certain other Guam localities.

2. *Mauritia (Arabica) arabica arabica* (Linnaeus, 1758)

(Plate 16, Figure 2)

Localities: 7 20 23 30 43 53 55

Largest shell:	51.4	33.0	25.0	28	27
Smallest shell:	37.8	24.3	19.4	27	21

This is one of the very few reasonably abundant cowrie species at Guam. It is more or less widely distributed in the rocky reef habitats, being found most commonly high up on the reef crowns. Apra Harbor seems to be the local center of distribution, with a noticeable thinning out of the populations elsewhere around the island.

3. *Mauritia (Arabica) eglantina* (Duclos, 1833)

(Plate 16, Figure 4)

Localities: 2 30 40 44 45 65

Largest shell:	50.0	29.6	24.0	35	33
Smallest shell:	41.0	23.4	19.0	34	30

This species is uncommon to rare. At present it is known only from a few scattered localities and is sometimes mistaken for *Mauritia a. arabica.* The Guam shells are generally small for the species when compared with those found elsewhere in the Pacific region.

4. *Mauritia (Arabica) maculifera* Schilder, 1932

(Plate 16, Figure 5)

Localities: 2 3 23 30 36 40 44 55 65

Largest shell:	58.8	37.0	28.1	28	27
Smallest shell:	35.5	23.3	17.7	25	20

This is a species that seems to range in a more or less restricted fashion throughout the breadth of the Pacific region, with its eastern terminus in the Clipperton Islands and Hawaii (see Cate, 1965, p. 57; plt. 8, figs. 26a, 26b); the northern half of the Philippines, Ryukyu Islands, Japan, and the Bonin Islands support the species in the west. These animals occur fairly commonly in the coastal waters of Guam, perhaps most abundantly in Tumon Bay. The shells do not attain as large a size as in the Hawaiian form (not much is presently known about the Clipperton Island shells, although they appear to be smaller at that locality), but resemble them in most other aspects.

5. *Mauritia (Arabica) depressa* (Gray, 1824)

Zool. Journ. 1: 77

(Plate 17, Figure 6)

Localities: 3 36 40 44 55

Largest shell:	41.1	29.6	21.0	22	19
Smallest shell:	41.0	29.4	20.8	24	19

This is an uncommon species; it approaches here the limits of its northern Pacific range as we presently know it in the central-west Pacific region. It is the form that is often confused with *Mauritia maculifera.* The appearance of the dorsal color pattern and design of *M. depressa* is in many cases almost identical with that of *M. maculifera.* Because of this it is necessary to consider the ventral features of the shell for identification. From the base the shell often seems to be more orbicular and more flattened,

the coloring is uniformly almost white to a very pale beige in some cases, with the teeth more even in length, particularly the columellar teeth. In contrast, the teeth of *M. maculifera* are irregular in length, becoming finer and shorter on the front half of the base. This feature and the dark blotch across the rear half of the base of *M. maculifera* are probably the most important separating characters in these very closely related species. I might mention that the shells of *M. depressa* are almost never as large as those of *M. maculifera;* the largest specimen in my experience is approximately 44 mm (from the Seychelles Islands).

6. *Mauritia (Arabica) scurra indica* (Gmelin, 1791)

(Plate 17, Figure 7)

Localities: 3 5 7 55

Largest shell:	40.1	19.9	16.5	44	34
Smallest shell:	31.8	15.2	12.1	42	30

This species is rare at Guam and is very seldom taken alive. For many years it was known only from 2 shells (according to H. Ward and E. Boyer, both of Agaña); one was beach-collected, the other live-taken. The latter was collected in 40 feet of water in Agaña Bay. Since these first shells were discovered, however, others have been collected, though infrequently. Because these shells have the more calloused base, a paler shell color and more numerous spots on the sides and their shape generally is more cylindrical and the size is smaller than these characters are in the nominate species, it seems that the Guam specimens belong to the subspecies under which I have discussed them.

7. *Mauritia (Mauritia) mauritiana* (Linnaeus, 1758)

(Plate 17, Figure 8)

Localities: 13 20 24 31 52 55 64 65

Largest shell:	91.6	66.6	45.0	25	23
Smallest shell:	90.0	66.4	44.7	24	23

These animals require highly oxygenated water; they occur in an environment where the waves pound the shore. Such habitats are encountered at Guam on the ocean side of the Glass Breakwater, at Ypao Point, Haputo Point, and in the Tarague area. In these localities the species is quite common, occurring to a depth of 25 feet.

8. *Talparia talpa* (Linnaeus, 1758)

(Plate 17, Figure 9)

Localities: 2 3 7 44 45 47 48 53 55 64

Largest shell:	64.1	32.5	27.0	42	36
Smallest shell:	59.0	32.4	26.9	47	38

These animals seem to have a life cycle that finds them disappearing from the intertidal zone at times, to reemerge after an interval of time. Even so, the species is not common. In this and some other Guamanian cowries I am made aware of how much they seem to resemble the Philippine and Ryukyuan species, both in size and appearance. There can be no doubt about the close similarity of the shells from these localities; yet this same fact does not apply in all cases. Some forms are missing here or exist in noticeably different aspects.

9. *Cypraea tigris schilderiana* Cate, 1961

The Veliger 3 (4): 108; plt. 19

(Plate 17, Figure 10)

Localities: 2 3 7 10 16 17 31 35 43 53 54 55 60

Largest shell:	92.1	69.5	50.0	26	23
Smallest shell:	90.0	63.6	45.6	25	22

The Micronesian form of this subspecies, not quite attaining the great size of the Hawaiian shells, nevertheless compares favorably with the latter. The general bulbous outline of the shell, the concavity of the base, with the length, shape, and arrangement of the teeth, and the simple dark color-spotting upon a white background, are all reminiscent of the Hawaiian shell (see Cate, 1965: p. 58; plt. 8, figs. 27a, 27b). It is a common species in Guam waters and can be found in most reef areas from the low tide line down to roughly 50 to 60 feet. Though they are often scattered about as single individuals, they are also frequently encountered in pairs or even in larger groups.

10. *Lyncina aurora* (Schröter, 1789)

Syn.: *Cypraea aurantium* Gmelin, 1791
(see Cate, 1966: p. 240; plt. 32, figs. 1a, 1b)

(Plate 17, Figure 11)

Localities: 1 7 17 28 40 50

Largest shell:	95.6	57.1	44.8	39	35
Smallest shell:	88.7	55.8	44.8	36	34

This is a rare species living in deep Guamanian waters. These animals were unknown in this area, it seems, until as recently as May or June of 1964, at which time Anthony Elbo, Agaña, collected the first specimen at Tantapalo Point in about 80 feet; subsequently 4 more were found by Thomas Cruz, Agaña, probably in the same general locality; another live specimen was collected by an unknown member of the United States Air Force. The

most recent specimens were taken dead in deep water off Lajes Rock by Mr. Herbert Ward, Agaña.

The 5 live-collected shells from off Tantapalo Point, Orote Peninsula, were living under huge basalt boulders. The single live animal taken off Anae Island was found in 45 feet in a small coral cave with a sandy bottom. In color and outward appearance the shells would be difficult to distinguish from those of the more southern parts of the range of this species. The 2 dead shells collected off Lajes rock were in about 70 feet of water.

11. *Lyncina argus* (Linnaeus, 1758)

(Plate 18, Figure 12)

Localities: 2 3 6 7 43 44 45 53

Shell data:	82.6	43.5	34.1	40	41

This is a rare species in Guam waters; I saw only an occasional specimen in the collections there. One specimen was found in 80 feet in Pago Bay; another was obtained from about 40 feet in a coral cave in the Asan-Piti area; still another was from the Apra Harbor Reef; and the specimen listed above (Cate coll. no. C1827) was collected at Agat Bay. This species is rarely taken alive here.

12. *Lyncina lynx* (Linnaeus, 1758)

(Plate 18, Figure 13)

Localities: 2 3 5 6 7 15 16 31 35 44 45 47 55 65

Largest shell:	61.0	34.2	29.1	34	25
Smallest shell:	29.0	17.1	14.5	22	18

This is a common species here and usually can be encountered in most of the reef areas. The species is well represented in most island collections. The large specimen listed above was collected at Merizo, the small one at Apra Harbor reef.

13. *Lyncina vitellus* (Linnaeus, 1758)

(Plate 18, Figure 14)

Localities: 2 3 6 7 31 36 44 45 47 55

Largest shell:	62.5	39.0	34.8	31	24
Smallest shell:	31.6	19.5	16.4	23	19

This has to be listed as a common species in Guam, although it is not at all abundant. It is represented in all the island collections, but not in as large numbers as the preceding species. It occurs in the reef areas in coral indentations and algae-lined pockets.

14. *Lyncina ventriculus* (Lamarck, 1810)

(Plate 18, Figure 15)

Localities: 2 3 40 53 65

Largest shell:	59.6	39.5	30.0	27	22
Smallest shell:	47.5	33.0	23.6	24	21

This species is uncommon to rare and is presently known from 4 feet of water at Shell Beach, Tipalao; it has been collected at Asan also. Most of the shells at Guam are of good size for the species, compared with representatives from the Cook Islands and the Philippines. The largest specimen listed above was collected at Orote Point, the other in Apra Harbor (Cate coll. nos. C3473 and C3509).

15. *Lyncina schilderorum* (Iredale, 1939)

(Plate 18, Figure 16)

Localities: 2 3 14 44 45 60

Shell data:	31.4	22.5	16.0	29	26

This species is rare in Guam waters, and is represented mostly by dead beach specimens. The single shell listed (Cate coll. no. C3494) was live-collected on the reef in Piti Bay in 1965. Because of the scarcity of the species, little is known about its general distribution at Guam.

16. *Lyncina carneola carneola* (Linnaeus, 1758)

(Plate 18, Figure 17)

Localities: 2 3 5 7 14 35 36 44 45

Largest shell:	39.3	24.7	20.7	28	22
Smallest shell:	25.8	15.9	13.4	25	20

Though only occasionally found, this species is relatively well represented in the island collections that I saw; but anyone to whom I talked referred to it as scarce. The shells are typical of the species and are of medium size for it, although there are many very small specimens with completely adult shells.

17. *Lyncina carneola leviathan* (Schilder & Schilder, 1937)

(Plate 19, Figure 18)

Localities: 2 3 4 7

Largest shell:	62.8	40.4	33.8	31	29
Smallest shell:	51.3	30.0	24.8	30	23

This relatively rare species has only recently been recognized at Guam as being distinct from *Lyncina carneola carneola*. This island locality may be near the western end of its range of distribution, for the shells seem to be not as large as those from the eastern part of the range. The principal differences between the 2 subspecies appear to be anatomical and in the size and weight of the shell (Kay & Weaver, 1963, p. 80).

18. *Chelycypraea testudinaria* (Linnaeus, 1758)

(Plate 19, Figure 19)

Localities: 2 3 5 31 47 55 65

Largest shell:	92.3	45.6	36.8	49	43
Smallest shell:	89.4	45.1	35.2	43	41

The species is rare; the largest specimen listed above was found in a submarine crater (World War II) off Cabras Island, the smaller shell was live-collected in a coral pocket off Asan Point. I saw the species represented only in a few island collections.

19. *Luria isabella* (Linnaeus, 1758)

(Plate 19, Figure 20)

Localities: 2 3 7 23 31 35 44 45 55

Largest shell:	29.0	16.3	13.6	36	27
Smallest shell:	18.4	9.5	7.8	36	23

The species is only fairly common. It lives in the algae covered coral in deep crevices and is most active at night. Shallow-water reefs are its main habitat.

20. *Erronea (Adusta) onyx onyx* (Linnaeus, 1758)

(Plate 22, Figure 38)

Locality: 7

Shell data:	39.2	24.6	20.2	22	22

This species is found only on the south shore of Apra Harbor and is very rare; it probably has reached here the northeastern limit of its range of distribution. The above specimen, collected prior to 1959 by B. J. Smith, Agaña, is in the Cate collection.

21. *Erronea (Erronea) ovum* (Gmelin, 1791)

(Plate 22, Figure 39)

Localities: 7 44 45

Largest shell:	27.9	17.1	13.8	15	15
Smallest shell:	27.1	17.0	13.3	13	18

This species heretofore has been mistaken for *Erronea errones* (Linnaeus, 1758); it was so labeled in some of the collections at Guam. The species is rare there and can easily be separated from the just mentioned species by the orange colored interstices on both lip and columella; the shell also is more pyriform. These northern shells seem to lack the dorsal blotch of brown seen on the shells from New Guinea and the southern Philippine area.

22. *Erronea (Erronea) errones* (Linnaeus, 1758)

(Plate 22, Figure 40)

Localities: 7 44 45

Shell data:	34.5	19.8	16.2	18	15

Known to be one of the more common species in the western Pacific region, this species is rarely taken by collectors at Guam; the shell listed here is from Apra Harbor and was taken alive by an unidentified SCUBA diver; it was found in very deep water at the mouth of the harbor.

23. *Erronea (Erronea) cylindrica* (Born, 1778)

(Plate 22, Figure 41)

Localities: 7 23 44 45

Largest shell:	32.3	14.2	11.1	18	24
Smallest shell:	19.2	9.8	7.8	13	15

Although fairly common, the species is nevertheless never abundant in Guam. The shells can be quite large as shown above, but for the most part they more often approximate the size of the smallest shell listed. It is also found as a subfossil in Apra Harbor sand pits.

24. *Erronea (Erronea) caurica* (Linnaeus, 1758)

(Plate 23, Figure 42)

Localities: 3 6 55 59

Shell data:	34.8	17.8	14.5	16	16

The shell listed here is in the Cate collection and is said to have been collected in 1955 by Mr. Herbert Ward, Agaña. There is little doubt of its being rare in these waters. Mrs. Phyllis Eliason and Mrs. Jean Allen, both of Agaña, report the species from Guam; Schilder (1938/1939) also lists the species from there, but I saw no specimens in Guamanian collections in 1966.

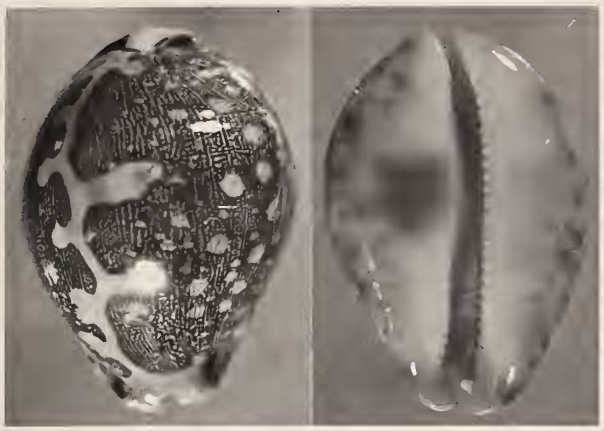


Figure 1

Mauritia mappa (LINNAEUS, 1758)
Asan × ⅔

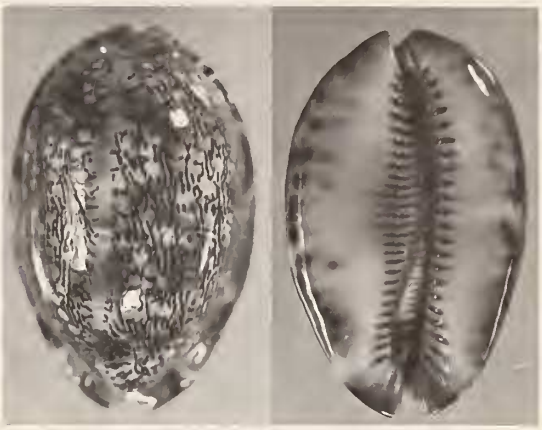


Figure 2

Mauritia arabica (LINNAEUS, 1758)
Apra Harbor × 1

Figure 3 a

Mauritia mappa (LINNAEUS, 1758)
Apra Harbor × ⅔

Figure 3 b

Mauritia mappa (LINNAEUS, 1758)
Apra Harbor × ⅔

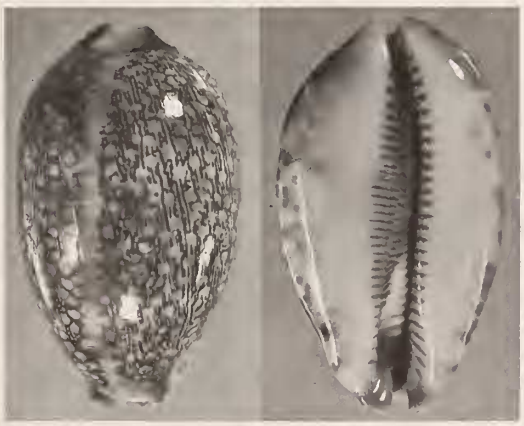


Figure 4

Mauritia eglantina (DUCLOS, 1833)
Piti Bay × 1

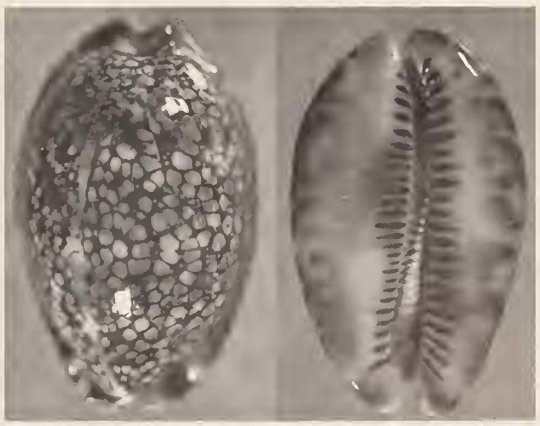


Figure 5

Mauritia maculifera SCHILDER, 1932
Asan × ¾

photographs by JEAN M. CATE

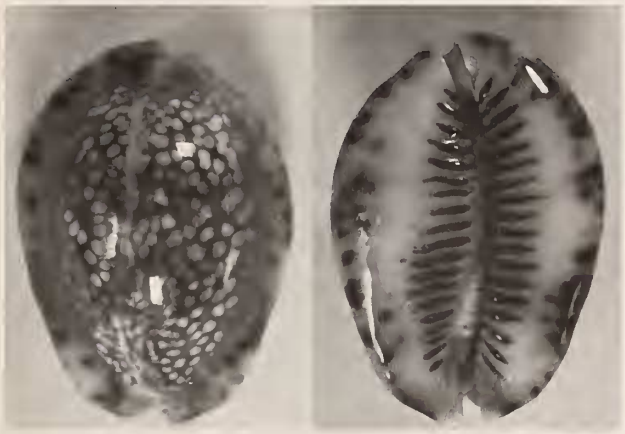


Figure 6

Mauritia depressa (GRAY, 1824)
Orote Point × 1⅓

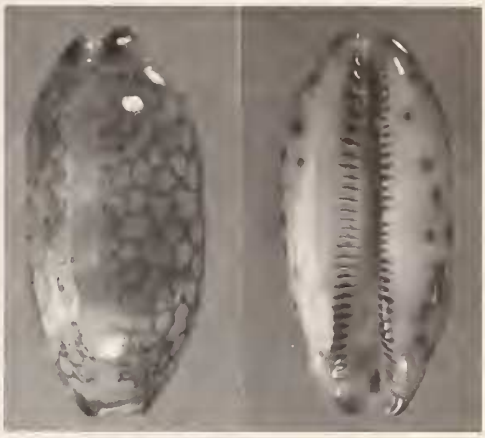


Figure 7

Mauritia scurra indica (GMELIN, 1791)
Agaña Bay × 1⅔

Figure 8

Mauritia mauritiana (LINNAEUS, 1758)
Tumon Bay × ½

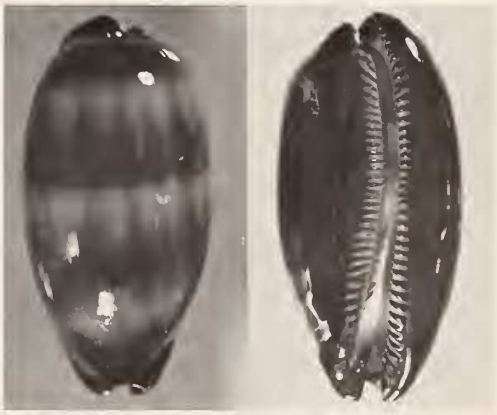


Figure 9

Talparia talpa (LINNAEUS, 1758)
Asan × ¾

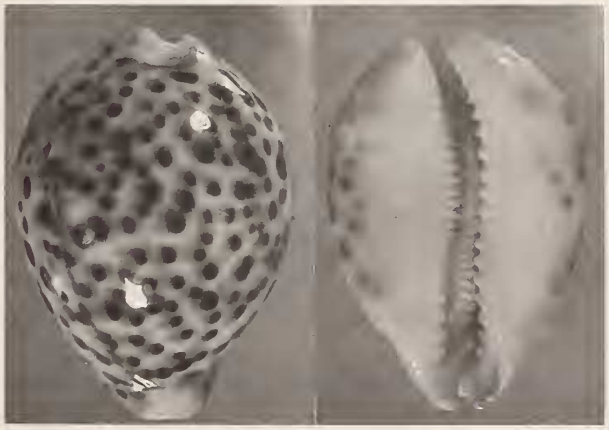


Figure 10

Cypraea tigris schilderiana CATE, 1961
Apra Harbor × ⅔

Figure 11

Lyncina aurora (SCHRÖTER, 1789)
Anae Island × ½

photographs by JEAN M. CATE

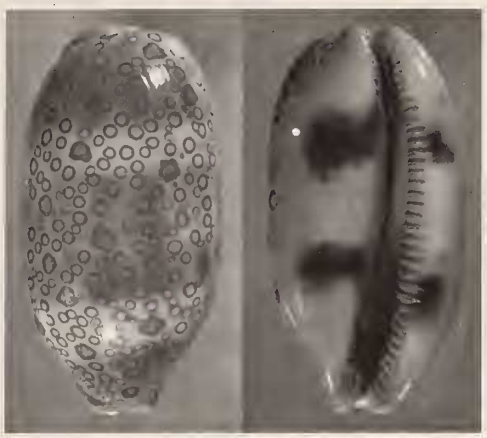


Figure 12

Lyncina argus (LINNAEUS, 1758)
Asan Point × ½

Figure 13

Lyncina lynx (LINNAEUS, 1758)
Merizo × ¾

Figure 14

Lyncina vitellus (LINNAEUS, 1758)
Merizo × ¾

Figure 15

Lyncina ventriculus (LAMARCK, 1810)
Orote Point × ¾

Figure 16

Lyncina schilderorum (IREDALE, 1939)
Piti Bay × 1⅔

Figure 17

Lyncina carneola carneola (LINNAEUS, 1758)
Tumon Bay × 1⅔

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